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(54) Measuring apparatus for determining the spacing between the backing roll mounting units of a four-high rolling stand

(57) The measuring apparatus, with which the spacing (12) is determined as a control magnitude for regulating the rolling gap, comprises two interchangeable housings (15) fitted in the lower backing roll mounting units (9) of the two standards of the four-high stand, symmetrical about the roll axial plane, with feelers (16) for two displacement measuring devices (17), which are fitted in the upper backing roll mounting units (8), the feelers being adapted to be extended and retracted and to bridge the spacing (12). The housings (15) each receive a lift cylinder (19) with a double-acting piston (20), on whose piston rod (22) is pushed a cylindrical sleeve forming the measurement feeler (16). Two clamping sleeves (28) directed oppositely to one another are fitted in each housing coaxial with the axis of the respective lift cylinder (19), with their clamping force so determined that the sleeve (16) is held in the measuring position, while extension and retraction of the same out of and into the measurement feeler housing is possible.

Fig. 2

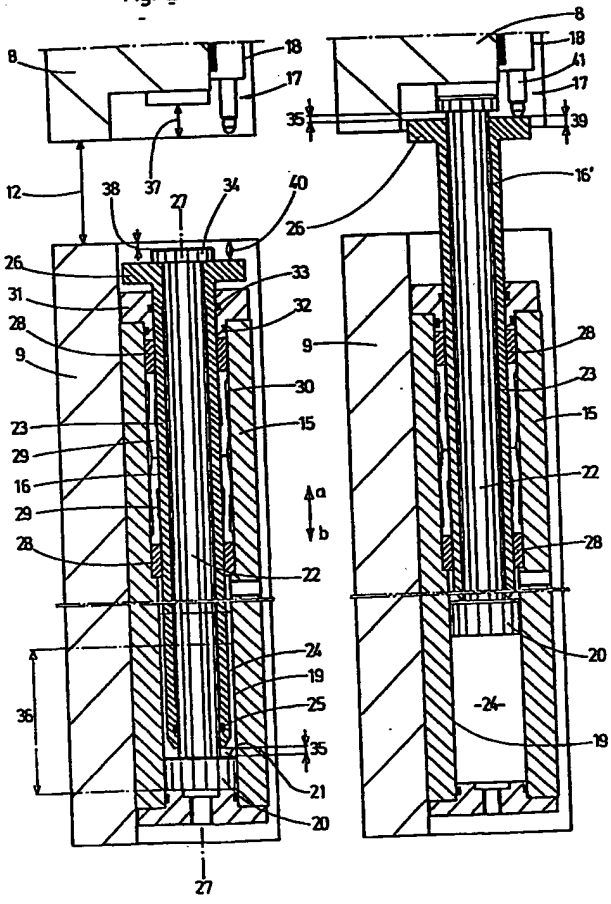

Fig. 3

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Fig. 1

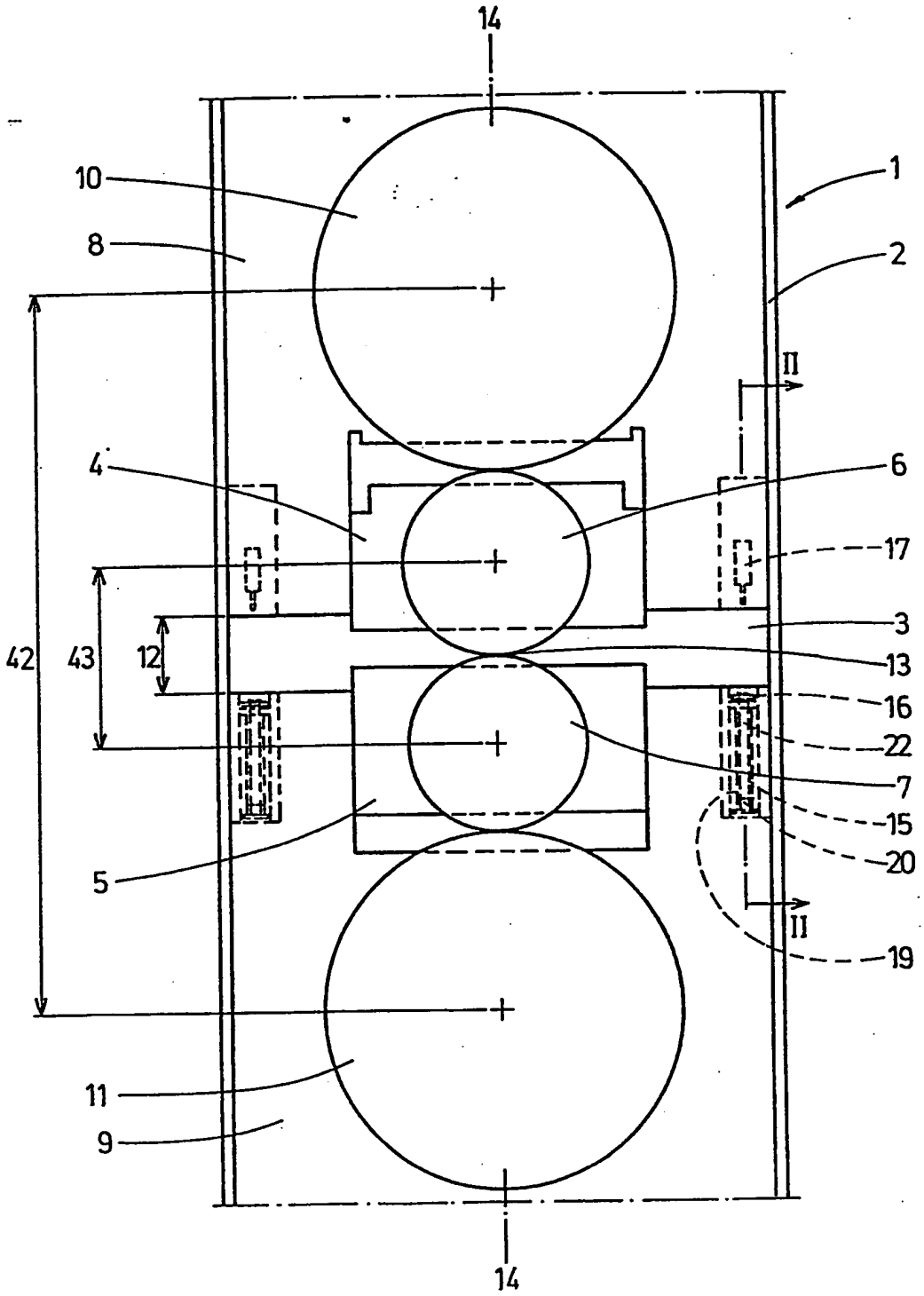

Fig. 2

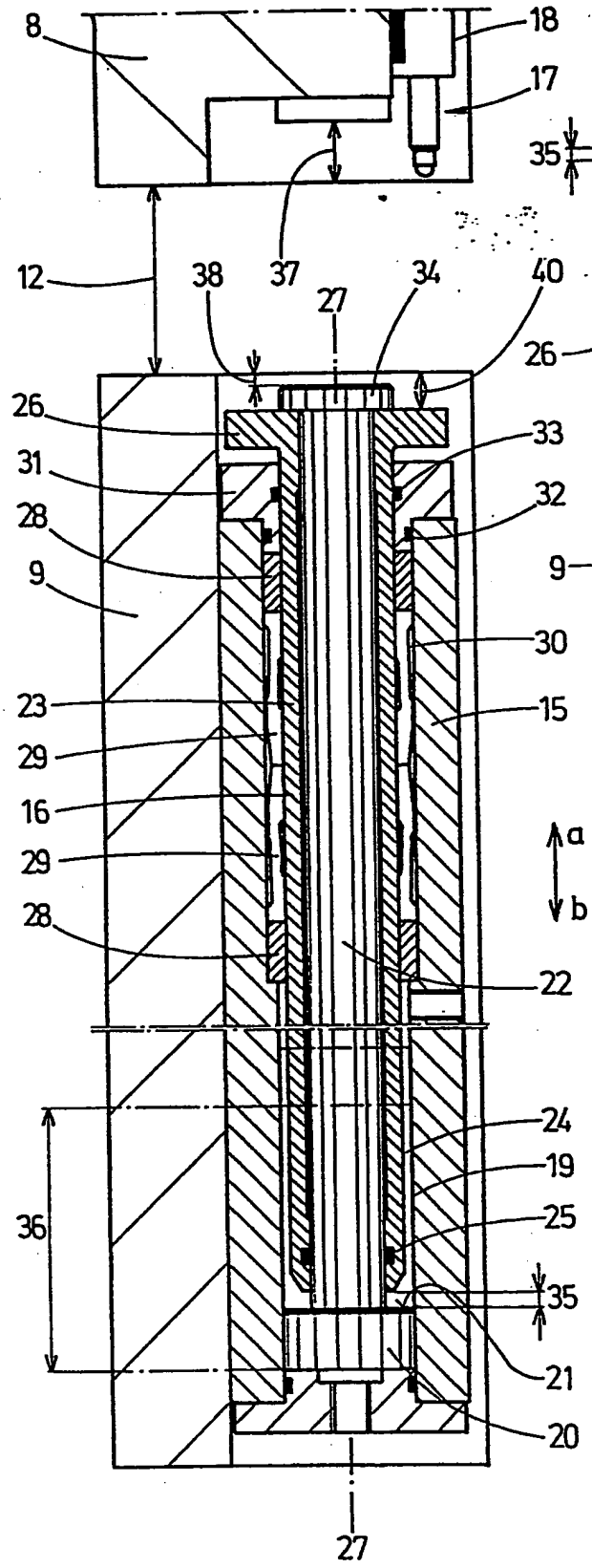
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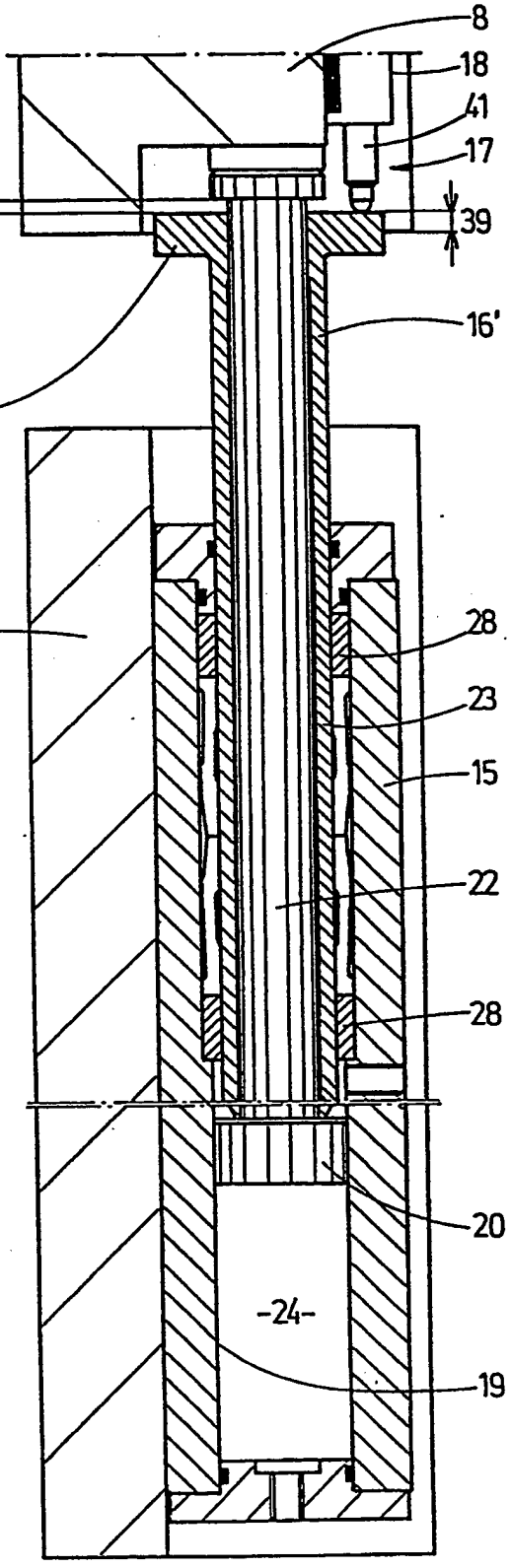
Fig. 3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Description

Title: Measuring apparatus for determining the spacing between the backing roll mounting units of a four-high rolling stand

This invention relates to a measuring apparatus for determining the spacing between the backing roll mounting units of a four-high rolling stand as a control magnitude for regulation of the rolling gap, with interchangeable housings for measurement feelers and displacement measurement devices fitted in the lower and upper backing roll mounting units of the two standards of the rolling stand symmetrically relative to the plane of the roll axes, wherein the housings of the measurement feelers receive double acting pistons in lift cylinders for extending and retracting the measurement feelers into the measuring and rest positions and a piston rod acting as a stop member is arranged on each piston, the stroke of the stop member on extending a measurement feeler out of a measurement feeler housing fitted in a lower or upper backing roll mounting unit into the measuring position for the displacement measuring device arranged in an upper or lower backing roll mounting unit being limited by the abutment formed by an upper or lower backing roll mounting unit, and a clamping sleeve for holding the measurement feeler in the measuring position is fitted in the housing of the measurement feeler, allowing axial movement of the measurement feeler in the extension and retraction of the same.

In one such measuring apparatus according to DE 2 439 580 C3 the measurement feelers fitted in the lower backing roll mounting units are formed as measurement pins for the displacement measuring devices arranged in the upper backing roll mounting units. Each measurement pin has an associated double acting piston which is arranged in a lift cylinder fitted parallel to the measurement pin of the measurement feeler housing and on whose lower piston face is fitted a piston rod, which is connected to the measurement pin through a coupling bridge for extending and retracting this pin into the measuring and rest positions respectively; the stroke of the measurement pin in its extension from the measurement feeler housing is limited by a piston rod arranged on the upper piston surface of the lift piston and acting as a stop member, which moves against an abutment in the upper backing roll mounting unit.

The disadvantages of this known measuring apparatus are to be seen in the relatively large mounting space required by the measurement feelers and the high manufacturing costs.

The invention is based on the object of developing a measuring apparatus which is distinguished by a simplified construction, a smaller demand on space and also lower manufacturing costs than the

measuring apparatus of the kind initially referred to.

This object is met according to the invention by a measuring apparatus with the features of claim 1.

The dependent claims contain advantageous developments of the measuring apparatus.

The measuring apparatus according to the invention represents a simple and advantageous solution to the stated object.

The invention will now be explained with reference to drawings, in which:

Figure 1 is a schematic view of a four-high rolling stand with the measuring apparatus according to the invention,

Figure 2 is a section to a larger scale on the line II-II of Figure 1 in the rest position of the measuring apparatus with the measurement feeler retracted, and

Figure 3 is a section corresponding to Figure 2 in operation of the measuring apparatus.

Figure 1 is a schematic view of a four-high rolling stand 1 with two standards 2, whose windows 3 receive an upper and a lower working roll mounting unit 4, 5 for mounting an upper and a lower working roll 6, 7 and an upper and a lower backing roll mounting unit 8, 9 for mounting an upper and a lower backing roll 10, 11.

The measuring apparatus, with which the spacing 12 of the backing roll mounting units 8, 9 is determined as a control magnitude for regulating the rolling gap 13, comprises two interchangeable housings 15 as the main components, fitted in the lower backing roll mounting units 9 of the two standards 2 of the four-high stand 1, symmetrical about the roll axial plane 14-14, with feelers 16 for two displacement measuring devices 17, which are fitted in interchangeable housings 18 in the upper backing roll mounting units 8, the transducers being adapted to be extended and retracted and to bridge over the space 12 between the backing roll mounting units 8, 9.

The housings 15 of the measurement feelers 16 each receive a lift cylinder 19 with a double acting piston 20, on whose piston face 21 directed towards the upper backing roll mounting unit 8 is fitted a piston rod 22. On the piston rod 21 there is pushed a cylindrical sleeve 23 acting as a measurement feeler 16, being sealed relative to the chamber 24 of the lift cylinder 19 by a sealing ring 25. The cylindrical sleeve 23 has an annular flange 26 at its end facing the upper backing roll mounting unit 8, acting as the contact member for the displacement measuring device 17 fitted in the upper backing roll mounting unit 8.

In the housing 15 of each measurement feeler 16 there are fitted two oppositely directed mechanical clamping sleeves 28 coaxial with the axis 27-27 of the lift cylinder 19, with spring tongues 29 whose

clamping force is so determined that the measurement feeler 16 for the displacement measuring apparatus formed as a cylindrical sleeve 23 is held securely in the measuring position 16' while extension and retraction of the same out of and into the housing 15 is possible. The clamping sleeves 28 are preferably made from non-ferrous metal.

The cylinder chamber 30 of the housing 15 receiving the clamping sleeves 23 extending along the lift cylinder 19 is closed by a cover 31, which is sealed relative to the housing 15 by a sealing ring 32 and relative to the cylindrical sleeve 23 by a sealing ring 33.

At the free end of the piston rod 22 of the lift cylinder 19 of the measurment feeler facing the upper backing roll mounting unit 8 there is fixed a disc 34 which serves as a stop member relative to the upper backing roll mounting unit 8 on extension of the cylindrical sleeve 23 into the measuring position 16' of the measurement feeler 16 and serves to entrain the cylindrical sleeve 23 on retraction of the cylindrical sleeve 23 into the rest position of the measurement feeler 16.

The cylindrical sleeve 23 of the measurement feeler 16 can be moved on the piston rod 22 through a predetermined dead stroke 35 between the disc 34 on the end of the piston rod 22 and the lift piston 20.

The maximum stroke 36 of the lift piston 20 of the measurement feeler 16 is determined by the nominal spacing 12 of the backing roll mounting units 8, 9 in use of the working rolls 6, 7 and the backing rolls 10, 11 with maximum diameters plus the depths 37, 38 to which the piston rods 22 penetrate into the upper and lower backing roll mounting units 8, 9. The depths 39, 40 to which the cylindrical sleeve 23 of the measurement feeler 16 penetrate into the upper and lower backing roll mounting units 8, 9 are at least equal to the negative measuring range of the displacement measuring device 17 fitted in the upper backing roll mounting unit 8 and preferably amount to 1 to 2.5 times the total measuring range of the displacement measuring device.

The measuring apparatus operates as follows:

When installing new or overhauled working and/or backing rolls 6, 7; 10, 11, the working rolls are retracted in the rolling stand 1 if desired with the backing rolls and the backing roll mounting unit 8, 9 are locked to the standards 2 by standard plates. The depth of grinding off of the possibly reworked rolls is compensated means of the mutual contact thereof. The measuring apparatus is now brought into play, the cylindrical sleeves 23 of the four measurement feelers 16 of a rolling stand 1 being extended out of the measurement feeler housings 15 in the arrow direction a into the measuring position 16', after overcoming the dead stroke 35. In this position the annular flange 26 of the cylindrical sleeve 23 comes into contact with the spring mounted sensor 41 of the associated displacement measuring

device 17 in the upper backing roll mounting unit 8. In the measuring position 16' of the measurement feeler 16 the displacement measuring device 17 is zeroed to its datum position so that it can operate in its measuring range. The rolling gap 13 is then adjusted to a set-point value by means of the measuring apparatus, through a control circuit, not described in detail, as well as hydraulic adjusting devices, by suitable adjustment of the backing roll axial spacing 42 and of the working roll axial spacing 43; this set-point value of the rolling gap 13 is held constant during the whole rolling operation by the measuring apparatus, through the control circuit and adjusting devices. During rolling, dynamic changes in the rolling gap 13 resulting from changes in strip thickness are converted into changes in the backing roll axial spacing 42 which in turn lead to a change in the spacing 12 between the backing roll mounting units 8, 9 monitored by the measuring apparatus. By means of the displacement measuring device 17, deviations in the rolling gap 13 from the set-point value are transmitted directly to the control circuit, which readjusts the set-point of the backing roll axial spacing 42 through adjusting devices. The bowing of the rolls is regulated by additional control devices, not explained in detail.

After extending the cylindrical sleeve 23 of each measurement feeler 16 into its measuring position 16', in which the measurement feeler is retained by the clamping sleeves 28, the lift piston 20 is relieved and held in a floating state by a hydraulic interlock, the hydraulic interlock being formed by pressure limiting valves, preloaded non-return valves or the like devices, which are connected to the lift cylinder 19 of the lift piston 20. The hydraulic interlock is so designed that, on apporach of the backing roll mounting unit 8, 9, a downwards stroke of the lift piston 20 in the direction of the arrow b is possible, while the dead stroke 35 of the piston rod 22 relative to the cylindrical sleeve 23 of the measurement feeler 16 associated with the downwards stroke of the lift piston 20 prevents the measurement feeler being moved out of its measuring position 16' by the lift piston 20. When the rolling stand is taken out of operation, the cylindrical sleeve 23 of each measurement feeler 16 can be retracted into the rest position in the measurement feeler housing 15 in the lower backing roll mounting unit 9, by the lift piston acting in the direction of the arrow b.

As a modification of the described embodiment the measuring apparatus can be fitted with hydraulic clamping sleeves for retaining the cylindrical sleeves 23 in the measuring position 16' of the measurement feeler 16.

It will be seen that the invention is characterized in that the measurement feelers 16 are formed as cylindrical sleeves 23 which are pushed on to the piston rods 22 of the lift pistons 20, are sealed relative to the chamber 24 of the lift cylinder 19 on the piston rods 22 and can be displaced through a predetermined dead stroke 35 on the piston rods 22, and in that at least one clamping sleeve 28 for each cylindrical sleeve 23 performing the measurement feeler function is fitted coaxial with the axis 27-27 of the lift cylinder 19 in the housing 15 of the measurement feeler 16.

CLAIMS:

1. A measuring apparatus for determining the spacing between the backing roll mounting units of a four-high rolling stand, with measurement feelers and displacement measurement devices fitted in the lower and upper backing roll mounting units of the two standards of the rolling stand symmetrically relative to the plane of the roll axes, and with double acting pistons in lift cylinders for extending and retracting the measurement feelers into the measuring and rest positions, a piston rod acting as a stop member being arranged on each piston, the stroke of the stop member on extending a measurement feeler into the measuring position for co-operation with a displacement measuring device being limited by abutment with an upper or lower backing roll mounting unit, and a clamping sleeve being provided for holding the measurement feeler in the measuring position, while allowing axial extension and retraction thereof, in which each of the measurement feelers is formed as a cylindrical sleeve which surrounds the piston rod of the lift piston, is sealed relative to the piston rod to close the chamber of the lift cylinder, and can be displaced through a predetermined dead stroke on the piston rod, and in which at least one clamping sleeve for each of the cylindrical sleeves serving as a measurement feeler is fitted coaxial with the axis of the lift cylinder.

2. A measuring apparatus according to claim 1, having a disc arranged on the free end of the piston rod which abuts the upper backing roll mounting unit when the cylindrical sleeve is extended and on retraction entrains the cylindrical sleeve.

3. A measuring apparatus according to claim 1 or 2 in which each cylindrical sleeve comprises an annular flange at the end facing the upper backing roll mounting unit to engage the displacement measuring device fitted in the upper backing roll mounting unit.

4. A measuring apparatus as claimed in any of claims 1 to 3 having two mechanical clamping sleeves fitted opposite one another around each feeler sleeve and having spring tongues for holding the feeler sleeve in the measurement position.

F ents Act 1977
Examiner's report to the Comptroller under Section 17 (The Search Report)

Application number
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Relevant Technical fields

(i) UK Cl (Edition L) G1M (MEBB, MEBX)

(ii) Int Cl (Edition 5) G01B 5/14

Search Examiner
M C MONK

Databases (see over)

(i) UK Patent Office

(ii) ONLINE DATABASE: WPI

Date of Search
18 AUGUST 1993

Documents considered relevant following a search in respect of claims ALL

Category (see over)	Identity of document and relevant passages	Relevant to claim(s)
	NONE	

Category	Identity of document and relevant passages	Relevant to claim(s)

Categories of documents

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